Income Distribution, Borrowing Constraints and Redistributive Policies

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February 1, 2000

Abstract

This paper proposes an explanation for why universal su¤rage has not implied larger rich-to-poor transfers of wealth. In the presence of borrowing constraints, if current taxation …nances (at least partially) policies that redistribute future income, the poor, who are more likely to be liquidity constrained, may form a coalition with the rich and vote for low redistribution. In this context, the e¤ects of an increase in income inequality on the level of redistribution depend on whether the increase in inequality is concentrated among the poor or the middle class. In the former case, an increase in inequality tends to decrease redistribution, whereas, in the latter case, it tends to increase redistribution. Empirical evidence for a panel of OECD countries provides support to our main thoretical implications. (JEL E62, H31)

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1. Introduction

Given existing inequality in income and wealth distribution, a natural question arises as to why the relatively poor majority does not use its political power to engage in larger redistribution and expropriation of the rich. If all citizens have the vote, and median wealth is less than the mean (as it is in reality) a majority of voters should prefer a tax rate of unity, fully redistributing all wealth to the mean.

In presence of distortionary costs of taxation, full expropriation is irrational. Yet, if the tax rate determined by majority voting is a decreasing function of the median/mean wealth or income ratio, the question remains open of why extension of su¤rage to the poorest segments of the population in the twentieth-century did not bring about the feared large expropriation of the rich via the tax system in western democracies.

Several explanations have been put forward to account for the fact that universal su¤rage has not implied larger rich-to-poor transfers of wealth.[1] For instance, it has been suggested that political systems are biased against the poor, who are well known to participate less than the rich to political activity[2]. Also, if political competition concerns more than one issue (e.g. tax policy and religion) the equilibrium tax rate proposed by the party protecting the interests of the poor may decrease, as the salience of the non-economic issue increases.[3] Finally, it has been pointed out that even people with below-average income will not support high tax rates if they expect to move upward the income ladder or if they recognize that there would be adverse dynamic e¤ects of expropriating the rich.[4]

An alternative way to pose the question is by asking why redistribution does not appear to be higher in more unequal societies. Casual observation of cross-country data shows that some of the most unequal countries of the world have relatively small welfare states. Benabou's [3] survey on inequality and growth summarizes recent empirical work in this area and concludes that inequality is not robustly associated with redistribution in cross-country data. In fact, the

[1] Putterman [14] reviews various explanations and tries to assess their degree of importance.

[2] For recent models developed along these lines, see Benabou [4] and Rodriguez [15].

[3] This argument has been recently advanced by Roemer [16].

[4] See Benabou and Ok [5] for a theoretical investigation of the former hypothesis. Perotti [11] includes the dynamic e¤ects of current redistribution among the aspects evaluated by rational voters.

statistical association between inequality and various measures of redistribution is rarely signi…cant and its sign, which is sometimes negative, heavily depends on the chosen speci…cation. Rodriguez [15] obtains evidence of a negative association between inequality and redistribution by examining a panel of OECD countries in the period 1960-1990 and provides a theoretical model which is consistent with it, based on the unequal political power of the rich and the poor. Saint-Paul and Verdier [18] brie‡y discuss various theoretical arguments that can give rise to a negative e¤ect of inequality on redistributive pressure.[5] In particular, as shown in Saint-Paul [17], an increase in inequality which a¤ects the bottom portion of the income distribution may imply an increase in the median/mean income ratio and therefore be associated with reduced taxation.

In this paper, we propose an alternative explanation for the non-expropriation of the rich in democracies, which provides useful insights on the relationship between inequality and redistribution and possible guidance in the speci…cation of empirical tests of such relationship. The central idea of our work is the following. We think of a world with credit market imperfections, where policies redistribute income (at least partially) in the future and have to be …nanced with current taxation. In this context, if agents vote over redistributive taxation, the median voter is not necessarily the agent (class) with median income. The poor segments of the population, who are more likely to be liquidity constrained, may vote for low redistribution, together with the rich. In this case, instead of having all agents below the mean voting for high redistribution, an ends-against-the-middle equilibrium may arise where the poor and the rich form a coalition in favor of low levels of redistribution.

Two observations are in order here. First, the type of policies we have in mind may include purely redistributive expenditures (such as social security and health expenditures), and expenditures that increase future labor productivity such as public education, on-the-job training, and public investment in infrastructure. Second, the choice of the method of …nancing is relevant in the political determination of government expenditures. We restrict the method of …nancing to current taxation in order to focus on the role of liquidity constraints in the polit-

[5] Peltzman [10] also presents a theoretical explanation of why the political pressure for redistribution should increase the more equal the distribution of income as well as empirical evidence consistent with it.

ical determination of redistribution.[6]

We formalize our main argument as follows. A two-period economy is inhabited by individuals who are heterogeneous with respect to their …rst-period labor productivity. In particular, we assume that there exist three income classes, the rich, the middle class and the poor. First-period income is homogeneous within classes and is below the mean for the two lowest income classes. Capital market imperfections exist such that, to some extent, agents may be prevented from borrowing as much as they should to carry out their optimal consumption plans. Fiscal policy is politically determined through majority voting in the …rst period. Such policy involves current proportional distortionary income taxation which is used to …nance either future lump-sum redistribution or current government expenditure, such as public investment in infrastructure and public expenditure on education, which increases the future productivity of labor.

In this context, the preferred tax rate will be decreasing with …rst-period income for agents who are not liquidity constrained, since the marginal cost of redistribution is higher for richer agents. Instead, the desired level of redistribution will increase with …rst-period income for agents who are borrowing constrained. The inability to borrow to …nance current consumption mitigates the incentives to expropriate the rich for liquidity constrained agents, the more so the larger the di¤erence between income and desired consumption in the …rst period.

This framework gives rise to di¤erent politico-economic equilibria, depending on the extent of borrowing constraints. When borrowing ceilings are high and no agent is liquidity constrained, the equilibrium tax rate will be the one preferred by the middle class. As the extent of borrowing constraints increases, a coalition of the poor and the rich is eventually formed, who favor a lower tax rate than the one preferred by the middle class. In other words, as borrowing ceilings fall, the identity of the median voter shifts from the middle class to the poor, who are borrowing constrained and are induced to decrease current taxation to increase current consumption. Since the e¢cient level of taxation is lower than the unconstrained optimal level of taxation of the middle class, higher degrees of borrowing constraints can be associated with higher levels of social welfare.

Our model has also interesting implications about the e¤ects of an increase

[6] Focusing on current taxation seems in line with the recent evolution of …scal policy in industrialized countries. Balanced-budget requirements have been recently introduced in the US. In Europe, the growth and stability pact strongly limits the possibility of debt …nancing.

in income inequality on the level of redistribution. These e¤ects turn out to depend on whether the increase in inequality is concentrated among the poor or the middle class. In the former case, an increase in inequality tends to lower redistribution, whereas, in the latter case, it tends to increase redistribution. It is worthwhile noting that the former case contrasts with the conclusions of recent theoretical studies (see, for example, Alesina and Rodrik [1], Benabou [3], Persson and Tabellini [13]) which build upon the frawework of Meltzer and Richard [9] and derive a positive relationship between inequality and redistribution.

In a recent paper, Saint-Paul [17] also obtains the result that more unequal societies can redistribute less if the increase in inequality is concentrated on the poorest. In his paper, the equilibrium tax rate decreases because the median income increases relative to the mean. In our set up, the result depends crucially on the change of identity of the median voter which is associated with higher inequality.

In the last part of this paper we perform an empirical analysis based on our theoretical implications about the relationship between income inequality and redistribution. Using pooled cross sectional-time series data for 22 OECD countries between 1960 and 1990, we …nd evidence that, when proxies for borrowing constraints are included among regressors, the e¤ect of changes in income inequality on redistributive expenditures (in particular, social security transfers and education expenditures) is negative (positive) if inequality is concentrated on the poor (middle) class. Our empirical results suggest that overlooking the role of borrowing constraints may prevent empirical studies to detect a signi…cant association between inequality and redistribution (as it happens, for example, in Perotti [12] and in several papers surveyed by Benabou [3]).

The plan of the paper is as follows. Section 2 describes the basic features of the model. In Section 3, we characterize the politico-economic equilibrium. Section 4 studies the relationship between inequality and redistribution, which is empirically analyzed in Section 5. Section 6 concludes.

2. The model

We will consider a two-period small open economy where agents are indexed by their …rst period endowment of human capital e_1^i. They belong to three income classes (poor, middle class and rich) denoted by $e_1^1 < e_1^2 < e_1^3$: The fraction of

people in each class is given by π^i with $0 < \pi^i < .5$ and $\sum_{i=1}^{3} \pi^i = 1$. We will assume that $e_1^2 < E_1$ and $e_1^3 > E_1$ where $E_1 = \sum_{i=1}^{3} \pi^i e_1^i$.

In their first period of life, agents allocate their income between consumption and saving. The rate of return on savings is exogenous and equal to r. We assume that in the first period agents cannot borrow more than $\theta - 1$ times their income to finance current consumption. The parameter $\theta > 1$ represents the degree of capital markets imperfection. When $\theta = 1$, agents cannot borrow at all; when $\theta \to \infty$, there are no market imperfections.

Individual income in the second period is given by $e_2^i = AG_1$ with $A > 1+r$. We can interpret G_1 in two different ways. First, it may represent public expenditure which increases the productivity of labor and is financed through proportional income taxation in the first period. In this case we can think of public expenditure on education and on-the-job-training or as public investment in infrastructure.[7] Second, it may represent purely redistributive expenditure that takes place in the second period, such as social security transfers.

We assume that there are convex costs of collecting taxes, so that if τ is the tax rate, the actual revenue is $\left(\tau - \tau^2\right) E_1$. Balanced budget implies that $G_1 = \left(\tau - \tau^2\right) E_1$.[8] The level of taxation is determined in the first period through majority voting. The tax rate which cannot lose under majority rule will be the equilibrium tax rate.

Preferences are represented by the following intertemporal utility function:

$$U^i = \log c_1^i + \beta \log c_2^i \tag{2.1}$$

where $\beta \in (0;1)$ denotes the intertemporal discount rate.

3. The politico-economic equilibrium

The politico-economic equilibrium is the solution of a two-stage maximization problem. First, given the level of taxation, agents choose consumption to max-

[7] In the former case, labor income in the second period may derive from a linear production function of the form $y_2^i = e_2^i$, where $e_2^i = A^{\gamma_1} e_1^{i\,\gamma_1} G_1^{\gamma_0}$. For simplicity, we set $\gamma = 0$ and $\gamma_0 = 1$. In the latter case, the production function would be $y_2^i = A e_2^{i\,\gamma_0} K_2^{G\,\gamma_0}$ where $e_2^i = {}^{\gamma_1} e_1^{i\,\gamma_1}$ and $K_2^G = G_1 + (1 - \pm) K_1^G$, with $\pm = 1$. In this case $A = K_1^G = 1$ in the first period.

[8] Collection costs are introduced in order to avoid corner solutions for the endogenous tax rate. An alternative (but analitically more complicated) way to avoid these solutions would be to endogenize labor choices.

imize their utility function given by equation (2.1) subject to the usual budget constraints. Second, given the consumption functions obtained in the …rst stage, agents choose the level of taxation which maximizes their indirect utility function.

The maximization problem in the …rst stage can be written as follows:

$$\begin{aligned} \max_{c_1^i;c_2^i} U^i &= \log c_1^i + \beta \log c_2^i \\ \text{s:to} \quad c_1^i &= (1 - \tau) e_1^i - s^i \\ c_2^i &= AG_1 + s^i (1 + r) \\ c_1^i &\geq \bar{A} (1 - \tau) e_1^i \end{aligned}$$

It is easy to verify that when the last constraint is not binding, the solution to the utility maximation problem yields:

$$\begin{aligned} c_1^i &= \frac{1}{1+\beta} \left[(1 - \tau) e_1^i + e_2^i / (1 + r) \right] \\ c_2^i &= \frac{\beta}{1+\beta} \left[(1 + r) (1 - \tau) e_1^i + e_2^i \right] \end{aligned} \tag{3.1}$$

In the second stage, agents choose the tax rate to maximize their indirect utility, obtained by substituting the optimal levels of consumption (3.1) in the utility function (2.1). Thus, the most preferred tax rate for agent i is the solution to the following problem:

$$\begin{aligned} \tau^i &= \arg\max \left[\log c_1^i + \beta \log c_2^i \right] \\ \text{s:to} \quad c_1^i &= \frac{1}{1+\beta} \left[(1 - \tau) e_1^i + A \left(\tau - \tau^2 \right) E_1 / (1 + r) \right] \\ c_2^i &= \frac{\beta}{1+\beta} \left[(1 + r) (1 - \tau) e_1^i + A \left(\tau - \tau^2 \right) E_1 \right] \end{aligned}$$

The …rst order condition of this problem is:

$$-(1 + r) e_1^i + \left[1 - 2\tau^i \right] AE_1 = 0 \tag{3.2}$$

which yields:

$$\tau^i = \frac{1}{2} - \frac{(1 + r) e_1^i}{2AE_1} \tag{3.3}$$

where $\tau^i > 0$, $(1+r)e_1^i < AE_1$: A standard result in the literature on the political economy of redistribution holds here: the richer is an agent, the lower is her preferred tax rate.

Equation (3.3) represents the optimal tax rate for agent i if and only if, given τ^i, agent i is not borrowing constrained. This requires that $c_1^i \geq \tilde{A}\left[1-\tau^i\right]e_1^i$. This condition can be written as follows:

$$e_1^i \geq \frac{AE_1}{(1+r)\left[2\tilde{A}(1+\beta)-1\right]} \tag{3.4}$$

If this inequality is satisfied for all three groups, the optimal tax rate for the middle class cannot lose under majority rule. Any tax rate lower than τ^2 will be opposed by a coalition of groups 2 and 3, whereas any tax rate higher than τ^2 will be opposed by a coalition of groups 1 and 2. Thus we can write the following:

Proposition 1. Assume condition (3.4) holds for $i = 1;2;3$. Then, the equilibrium tax rate will be τ^2 with $\frac{\partial \tau^2}{\partial e_1^2} < 0$:

As we just discussed, the tax rate given by equation (3.3) is the optimal policy for agent i if and only if, given this level of taxation, agent i is not liquidity constrained. In the remaining of the paper, we will assume that $e_1^i < \frac{AE_1}{(1+r)[1+2\beta]}$ for $i = 1;2$.[9] This implies that, when the extent of liquidity constraints is sufficiently high, the borrowing constraint will be binding for the poor and the middle class. In other words, there exists $\tilde{A}^i \equiv \left[AE_1 + (1+r)e_1^i\right] \div \left[2(1+\beta)(1+r)e_1^i\right] > 1$ such that if $\tilde{A} < \tilde{A}^i$ agent i will be liquidity constrained (notice that $\tilde{A}^1 > \tilde{A}^2$). If this is the case, agent i chooses her preferred tax rate by solving the following problem:

$$\tau^{ic} = \arg\max_{\tau} \left\{\log c_1^i + \beta \log c_2^i\right\} \tag{3.5}$$

$$\text{s.to} \quad \begin{aligned} c_1^i &= \tilde{A}(1-\tau)e_1^i \\ c_2^i &= (1+r)(1-\tilde{A})(1-\tau)e_1^i + A\left[\tau - \tau^2\right]E_1 \end{aligned}$$

[9] This simplifying assumption rules out the possibility that the rich become liquidity constrained and that political equilibria emerge where, for low levels of $\tilde{A}$; the rich prefer the highest level of taxation and form a coalition with the middle class. However, our main results would be unchanged if we dropped this assumption.

The …rst order condition of this problem is given by:

$$¡1 ¡ \frac{(1+r)(1¡\tilde{A})e_1^i + AE_1(1¡2¿)}{(1+r)(1¡\tilde{A})e_1^i + AE_1¿} = 0 \tag{3.6}$$

which yields:

$$¿^{ic} = \frac{\bar{}AE_1 + (1+\bar{})(1+r)(\tilde{A}¡1)e_1^i}{(1+2\bar{})AE_1} \tag{3.7}$$

We can now prove the following preliminary results:

Proposition 2. (1) $\frac{@¿^{ic}}{@\tilde{A}} > 0$ (2) $¿^{ic} \cdot ¿^i$ (3) $\frac{@¿^{ic}}{@e_1^i} > 0$ (4) When $\tilde{A} = 1$; $¿^{ic} > 0$:

Proof. (1) Take derivative of equation (3.7) with respect to $\tilde{A}$. (2) When $\tilde{A} = 1$, $¿^{ic} < ¿^i$, $AE_1 > (1+2\bar{})(1+r)e_1^i$ which we already assumed to hold. Since $\frac{@¿^{ic}}{@\tilde{A}} > 0$ and $¿^{ic} = ¿^i$ when $\tilde{A} = \tilde{A}^i$; this concludes the proof. (3) Take derivative of equation (3.7) with respect to e_1^i. (4) Substitute $\tilde{A} = 1$ in equation (3.7). ■

Since redistribution takes place in the second period, the poor and the middle class may hit the borrowing ceiling at their unconstrained optimal tax rate. In this case, in order to relax the borrowing constraint, they will reduce their preferred level of taxation and increase the level of current consumption. The lower is the extent of borrowing constraints, the higher is the desired degree of expropriation by the low-income classes. Contrary to the standard theoretical result (illustrated for example by Meltzer and Richard [9]) of a negative relationship between personal income and desired redistributive taxation, here the preferred tax rate increases with income.[10]

Now, we can state the main result of this section:

Proposition 3. There exists a $\hat{A} 2 \left[\tilde{A}^2; \tilde{A}^1\right]$ such that (1) for $\tilde{A} 2 \left[\hat{A}; 1\right]$ the equilibrium tax rate is $¿^2$ (2) for $\tilde{A} 2 \left[1; \hat{A}\right)$, the equilibrium tax rate is $¿^{1c} < ¿^2$:

Proof. First, we know that at $\tilde{A}^2$; $¿^{1c} < ¿^2$(immediate: at $\tilde{A} = \tilde{A}^2$; $¿^2 = ¿^{2c} > ¿^{1c}$): Next, we know that at $\tilde{A}^1$; $¿^{1c}_{\tilde{A}^1} = ¿^1 > ¿^2$: Since $@¿^{1c}=@\tilde{A} \geq 0$, there must exist a $\hat{A} 2 \left[\tilde{A}^2; \tilde{A}^1\right]$ such that $¿^{1c}\left(\hat{A}\right) = ¿^2$: Thus, for $\tilde{A} 2 \left[\hat{A}; \tilde{A}^1\right]$, preferred tax

[10] Clearly, the introduction of public debt may alter the most preferred tax rates in the presence of liquidity constraints. However, it can be shown that the incentive to reduce the amount of redistribution would still be present even if debt …nancing is allowed.

rates are such that $¿^3 < ¿^2 < ¿^{1c}$ and $¿^2$ cannot lose under majority rule. For $Ã \in [Ã^1; 1)$, $¿^3 < ¿^2 < ¿^1$ and $¿^2$ cannot lose under majority rule. Thus for $Ã \in [Â; 1)$, the equilibrium tax rate is constant. For $Ã \in [Ã^2; Â)$; $¿^3 < ¿^{1c} < ¿^2$ and $¿^{1c}$ cannot lose under majority rule. For $Ã \in [1; Ã^2)$; $¿^3 < ¿^{1c} < ¿^{2c}$ and $¿^{1c}$ cannot lose under majority rule. ■

The intuition for this result can be grasped by looking at Figure 1. As this …gure shows, the identity of the median voter depends on the extent of borrowing constraints. On the one hand, if the degree of borrowing constraints is low, that is $Ã > Â$, the equilibrium tax rate is the optimal unconstrained tax rate for the middle class $¿^2$ which lies between the preferred tax rates of the poor and the rich. On the other hand, when borrowing constraints are strong enough ($Ã < Â$), the preferred tax rate of the poor (who are now liquidity constrained) is su¢ciently low for them to become the median voter. Thus, the change in the median voter identity implies that the equilibrium tax rate is increasing with Ã:

Our model has interesting welfare implications. Let us consider the relationship between the tax rate that arises in our politico-economic equilibrium and the e¢cient tax rate. The e¢cient tax rate maximizes the present discounted value of aggregate disposable income and is given by $¿^¤ = \frac{1}{2} ¡ \frac{(1+r)}{2A}$: Clearly, the relationship between the latter tax rate and the equilibrium tax rate depends on the extent of borrowing constraints. In particular, we can show the following result:

Proposition 4. The present discounted value of aggregate disposable income is decreasing with Ã for $Ã \in [1; 1)$ if and only if $A < (1 + 2^{¯})(1 + r)$: Otherwise, it is increasing with Ã for $Ã \in [1; Ã^¤)$ and decreasing with Ã for $Ã \in [Ã^¤; 1]$, where $Ã^¤ < 1$ is implicitly de…ned by $¿^{1c}(Ã^¤) = ¿^¤$.

Proof. The present discounted value of aggregate disposable income is a strictly concave function of the tax rate and reaches a maximum for $¿ = ¿^¤$. If and only if $A < (1 + 2^{¯})(1 + r)$, the equilibrium tax rate is larger than $¿^¤$ for any value of Ã. Otherwise, the equilibrium tax rate is below $¿^¤$ for any $Ã < Ã^¤$. By Proposition 3 ¿ is monotonically increasing with Ã, which concludes the proof. ■

Notice that the level of welfare may increase as the extent of borrowing constraints increases. This result is due to the fact the existence of borrowing con-

straints limits the incentives to vote for high levels of distortionary redistributive taxation.

4. Income inequality and redistributive policies

So far, we have analyzed how the politico-economic equilibrium responds to changes in the extent of borrowing constraints. Now, we want to investigate how the equilibrium …scal policy changes when income distribution is altered. In particular, we will study the relationship between redistributive policies and income inequality. In order to do so, we will consider increases in the initial income of the rich e_1^3 coupled with decreases in the initial income of the poor e_1^1 or the middle class e_1^2. These modi…cations are assumed to leave the mean income E_1 una¤ected.

As we will immediately see, these two distinct ways of increasing income inequality have di¤erent implications on the equilibrium of the model. If we begin with the case where the income of the poor is reduced, we can prove the following result:

Proposition 5. Ceteris paribus, a mean-preserving reduction of e_1^1 will decrease (or leave una¤ected) the equilibrium tax rate.

Proof. Consider the graph in Figure 2. Following the change in the distribution of income, $\tilde{A}^1$ and $\hat{A}$ move to the right. There is now a larger subset of $\tilde{A}$ such that the poor is the median voter. This subset is given by $\left[\hat{A}; \hat{A}^0\right)$. Within this subset, $\iota^{1c} < \iota^2$. Since, for $\tilde{A} < \hat{A}$, the poor is still the median voter and $\iota^{1c'} < \iota^{1c}$; this concludes the proof. ■

The above result di¤ers from the conclusions of many recent theoretical studies (see, for example, Alesina and Rodrik [1], Benabou [3], Persson and Tabellini [13]) which, along the lines of Meltzer and Richard [9], derived a positive relationship between inequality and redistribution. Instead, our last proposition shows that, if the increase in inequality is generated by a decrease in the income of the poor, the degree of redistribution will actually decrease (or remain constant). The intuition for this result can be illustrated by observation of Figure 2. For $\tilde{A} < \hat{A}$, the poor is still the median voter and the equilibrium tax rate decreases because the constrained optimal tax rate is increasing with income (see equation (3.7)).

In the interval $\left[\tilde{A}; \tilde{A}^{0}\right)$; the identity of the median voter changes from the middle class to the poor and the equilibrium tax rate decreases. Finally, for $\tilde{A} > \tilde{A}^{0}$ the middle class is still the median voter and the level of redistribution is unchanged.

If we now perform the same experiment with respect to the initial income of the middle class, we obtain the following result:

Proposition 6. Ceteris paribus, a mean-preserving reduction of e_1^2 will increase (or leave una¤ected) the equilibrium tax rate.

Proof. Consider the graph in Figure 3. Following the change in the distribution of income, $\tilde{A}^2$ and $\tilde{A}$ move to the right. There is now a larger subset of $\tilde{A}$ such that the poor is the median voter. This subset is given by $\left[\tilde{A}; \tilde{A}^{0}\right)$: Within this subset, $¿^{1c} > ¿^{2}$: Moreover, for $\tilde{A} > \tilde{A}^{0}$, the middle class is still the median voter and $¿^{2'} > ¿^{2}$: This concludes the proof. ■

As the last result makes clear, when the increase in income inequality is caused by a decrease in the income of the middle class, the e¤ect on the amount of redistribution is the one which is usually predicted by the literature on the political economy of redistribution. In this case, the higher is the inequality, the higher (or constant) is the amount of redistribution. Let us consider Figure 3. For $\tilde{A} < \tilde{A}$, the poor is still the median voter and the equilibrium tax rate is unchanged. In the interval $\left[\tilde{A}; \tilde{A}^{0}\right)$; the identity of the median voter changes from the middle class to the poor and the equilibrium tax rate increases. Notice that the preferred tax rate of the middle class at lower income level is now higher than the preferred tax rate by the poor. Finally, for $\tilde{A} < \tilde{A}^{0}$ the middle class is still the median voter and the level of redistribution increases.

To summarize, the existence of borrowing constraints implies that the relationship between inequality and redistribution depends on which class is mostly a¤ected by the income change. If the increase in inequality is concentrated among the poor (middle class), redistribution tends to decrease (increase) in equilibrium. Moreover, whether or not a given change of income distribution brings about a change in the amount of redistribution depends on the extent of borrowing constraints.

5. Empirical analysis

In this section we perform an empirical analysis based on the main theoretical conclusions of our model. More speci…cally, we concentrate on the relationship between income inequality and redistributive expenditure, as implied by Proposition 3, 5 and 6.

According to these results, two elements should be taken into account in order to investigate the association between inequality and redistribution. First, due to the existence of borrowing constraints, the predicted sign of the relationship depends on whether the increase in inequality is concentrated among the poor or the middle class: in the former case, more inequality implies less redistribution, while the opposite is true in the latter case. Second, the degree of borrowing constraints determines the identity of the median voter and thus whether a change in the income distribution a¤ects redistributive expenditure.

Our data set covers 22 OECD countries in the period 1960-1990. As a proxy for the extent of borrowing constraints we use the maximum loan-to-value (LTV) ratio for house purchases collected by Jappelli and Pagano [8] for the three periods 1961-1970, 1971-1980 and 1981-1987.[11] Data on income distribution are taken by Deininger and Squire [7]. As proxies for the income share of the poor and the middle class, we use the share of income of the second quintile (SEC) and of the third quintile (TH). We choose observations as close as possible to the beginning of the above subperiods. Finally, as proxies for redistributive expenditures we use ten-year averages of social security transfers over GDP (SS) and government expenditure on education over GDP (EDU) which we take from Rodriguez [15]. All remaining variables come from Barro and Lee [2]. Table 1 reports some descriptive statistics for our data set. A detailed description of the data set can also be found in the Appendix.

In order to test the main implications of our model, we specify the following equations:

$$(G=Y)_{it} = \alpha_1 + X_{it}^{0}\beta_1 + \gamma_1 SEC_{it} + \delta_1 HBC_{it} + \theta_1 SHBC_{it} + u_{it} \qquad (5.1)$$

[11] See De Gregorio [6] for a discussion of di¤erent proxies for the extent of borrowing constraints.

$$(G=Y)_{it} = \alpha_2 + X_{it}'\beta_2 + \gamma_2 TH_{it} + \delta_2 LBC_{it} + \theta_2 TLBC_{it} + v_{it} \qquad (5.2)$$

where i denotes country and t denotes time period, $G=Y$ is the share of public expenditure (social security or education) in GDP, X is a vector of conditioning variables other than distributional variables, HBC (LBC) is a dummy variable which proxies for high (low) borrowing constraints and takes value one when the LTV ratio is above (below) a given threshold. Finally, the two interaction terms $SHBC$ and $TLBC$ are de…ned as $SEC \times HBC$ and $TH \times LBC$, respectively.

According to the results of Propositions 5 and 6, a reduction in the income share of the poor (middle class) implies a decrease (increase) in the equilibrium share of public expenditure in GDP if the degree of borrowing constraints is above (below) a certain threshold. Otherwise, the change in income distribution will leave the equilibrium level of redistribution una¤ected.

Therefore, the predicted sign of coe¢cients appearing in equations (5.1) and (5.2) is $\gamma_1 = \gamma_2 = 0$, $\theta_1 > 0$ and $\theta_2 < 0$. Since we have no a priori indication on the "true" value of the threshold that we use to de…ne the high and low borrowing constraints regimes, we select the one that yields the most signi…cant estimated coe¢cient for interaction terms in the equations we estimate. This turns out to be $\overline{LTV} = 70$ when the dependent variable is EDU and $\overline{LTV} = 75$ when the dependent variable is SS; for both equations that we speci…ed.[12]

If the interaction terms are omitted from equations (5.1) and (5.2) (that is, if the role of borrowing constraints in shaping the relationship between inequality and redistribution is not taken into account), the estimated coe¢cients of distribution variables are expected to decrease in absolute value and possibly become insigni…cant. Moreover, the estimated coe¢cients of interaction terms should decrease (with respect to the interaction term coe¢cient) and possibly become insigni…cant as we move the threshold value de…ning borrowing constraints regimes in either direction.[13] In fact, according to our model, these experiments amount

[12] Inspection of Figures 2 and 3 shows that, according to our theoretical results, the threshold value used to de…ne high and low borrowing constraints regimes should turn out to be higher when we consider variations of the poor's income share (see equation (5.1)). The fact that this implication of the model is not born out by empirical evidence might be due to the discrete nature of data on borrowing constraints.

[13] In particular, we will consider threshold values of LTV ranging from 65 to 80. This ensures that dummy variables take value one for at least one fourth of the observations included in the sample.

to including irrelevant observations and/or exclude relevant observations in the estimation of the (conditional) correlation between inequality and redistribution.

Tables 2 and 3 display estimation results obtained applying one-way (country dummies) …xed (OLS) and random e¤ects (GLS) estimators to equations (5.1) and (5.2), including or not interaction terms. Results from the random e¤ects model are reported whenever the Hausman test does not reject the null hypothesis of no systematic di¤erence in coe¢cients estimates obtained by the two methods.

Conditioning variables include the log of GDP (LGDP) and the log of population (LPOP), to capture the notion that richer countries can a¤ord to redistribute more income (Wagner's Law) and the presence of economies of scale in production of public goods. Moreover, the share of population over 65 years of age (OLD) and the share of population below 15 years of age (YOUNG) are used in regressions with SS and EDU appearing as dependent variable respectively.

Estimation results provide encouraging evidence in favor of our theoretical implications, especially as far as reductions in inequality are concentrated among the poor. First, inspection of Table 2 shows that the estimated coe¢cients of interaction terms have the predicted signs and are signi…cant at 5% con…dence level in all equations. These coe¢cients decrease in absolute value and become less signi…cant as we revise upwards and downwards the threshold value de…ning borrowing constraints regimes (not shown). Second, the estimated coe¢cient of SEC in columns 1 and 3 of Table 2 is insigni…cantly di¤erent from zero. Third, the estimated coe¢cient of SEC in columns 1 and 3 of Table 3 is lower than the corresponding estimated coe¢cients of SHBC in Table 2.

When reductions in inequality are concentrated among the middle class, the empirical results reported in Table 2 (columns 2 and 4) and Table 3 (columns 2 and 4) are less supportive of our implications, at …rst sight. Although there is evidence that, in the low borrowing constraints regime, redistribution is negatively associated with increases in TH (reduction in inequality concentrated among the middle class), the latter seem to be positively associated with redistribution in the high borrowing constraints regime. Instead, since the poor are median voter in presence of high borrowing constraints, our model implies that the equilibrium tax rate should not respond to mean-preserving increases in the income share of the middle class, provided that the poor's income share is una¤ected. This caveat suggests one way of reconciling the above empirical results with the predictions of our model. In particular, we argue that TH in equations 2 and 4 of Table 2 may

be proxying for the omitted variable SEC. Inclusion of SEC among regressors in equation (5.2) provides evidence in favor of this hypothesis, as shown in columns 5 and 6 of Table 2.

Robustness analysis conducted on the OLS (…xed e¤ects) estimates showed that our empirical results are robust to various sources of misspeci…cation bias, such as heteroschedasticity (Cook and Heisberg test), and outliers (robust regression). In particular, robust regression estimation tends to increase signi…cance of coe¢cients. Moreover, an omitted test (RESET) shows that the null hypothesis of no omitted variables is rejected (accepted) when interaction terms are omitted (included).[14]

Summing up, our empirical analysis seems to support the idea that borrowing constraints play a signi…cant role in shaping the relationship between inequality and redistribution, by determining the identity of the median voter. The fact that the role of borrowing constraints was so far overlooked might therefore provide a possible explanation for why recent empirical studies on inequality and redistribution (see for example Perotti [12] and the discussion in Benabou [3]) failed to …nd evidence of a signi…cant association between these variables.

6. Conclusion

By incorporating capital market imperfections in a political economy model of income redistribution, this paper provides an explanation for why the majority of the population, whose income is below the mean, does not use its political in‡uence to engage in large expropriation of the rich. Moreover, contrary to the standard implications of the public choice analysis of the size of government, our model shows that increasing inequality can be associated to reduced political support for redistributive taxation.

Our model may add useful insights to the empirical analysis of the relationship between income inequality and redistribution. As reported by Benabou [3], a statistically signi…cant association between inequality and redistribution does not emerge from available data. Following the main implications of our model, we suggest that, in order to obtain better estimation results, it is important to specify on which class the increase in income inequality is concentrated and to control for the existence and extent of borrowing constraints. An empirical analysis

[14] Robustness testing results are available from the authors upon request.

conducted along this direction using pooled cross sectional-time series data for 22 OECD countries between 1960-1990 lends support to our main theoretical predictions.

References

[1] Alesina, A. and D. Rodrik (1994), "Distributive Politics and Economic Growth", Quarterly Journal of Economics, 109(2), 465-490.

[2] Barro, R. J. and J. Lee (1994), Data Set for a Panel of 138 Countries.

[3] Benabou, R. (1996), "Inequality and Growth", NBER Working Paper no. 5658.

[4] Benabou, R. (1998), "Unequal Societies", forthcoming, American Economic Review.

[5] Benabou, R. and E.A. Ok (1998), "Social Mobility and the Demand for Redistribution: the POUM Hypothesis", CEPR Discussion Paper no. 1955.

[6] De Gregorio, J. (1996), "Borrowing Constraints, Human Capital Accumulation and Growth", Journal of Monetary Economics, 37, 49-71.

[7] Deininger, K. and L. Squire (1996), "A New Data Set Measuring Income Inequality", World Bank Economic Review, 10(3), 565-591.

[8] Jappelli, T. and M. Pagano, (1994), "Saving, Growth and Liquidity Constraints", Quarterly Journal of Economics, 109, 83-109.

[9] Meltzer, A. H. and S. F. Richard, (1981), "A Rational Theory of the Size of Government", Journal of Political Economy, 89, 914-927.

[10] Peltzman, S., (1980), "The Growth of Government", Journal of Law and Economics, 23, 209-288.

[11] Perotti, R., (1993), "Political Equilibrium, Income Distribution and Growth", Review of Economic Studies, 60, 755-776.

[12] Perotti, R., (1996), "Growth, Income Distribution and Democracy: What the Data Say", Journal of Economic Growth, 1, 149-187.

[13] Persson, T. and G. Tabellini (1994), "Is Inequality Harmful for Growth: Theory and Evidence", American Economic Review, 84(3), 600-621.

[14] Putterman, L. (1997), "Why Have the Rabble Not Redistributed Wealth? On the Stability of Democracy and Unequal Property," in Roemer, J.E. (Ed.), Property Relations, Incentives, and Welfare. London: Macmillan.

[15] Rodriguez, F. (1998), "Inequality, Redistribution and Rent-Seeking", Univerisity of Maryland, mimeo.

[16] Roemer, J.E. (1998), "Why the Poor Do Not Expropriate the Rich: an Old Argument in New Garb", Journal of Public Economics, 70, 399-424.

[17] Saint-Paul, G., (1998), "The Dynamics of Exclusion and Fiscal Conservatism", mimeo.

[18] Saint-Paul, G. and T. Verdier (1996), "Inequality, Redistribution and Growth: a Challenge to the Conventional Political Economy Approach," European Economic Review, 40, 719-728.

7. Appendix

List of countries

Our sample includes data for 22 countries in the period 1960-1990. Countries are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, West Germany, Greece, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Turkey, United Kingdom, United States.

Description of variables and data sources

- EDU Ratio of nominal government expenditure on education to nominal GDP (10-year averages). Source: UNESCO.
- LGDP Log value of real GDP per capita (1980 international prices). Source: Barro and Lee [2].
- LPOP Log value of total population. Source: Barro and Lee [2].
- LTV Maximum loan-to-value ratio for the purchase of a house. Source Jappelli and Pagano [8].
- OLD Population proportion over 65. Source: Luxembourg Income Study.
- SEC Share of income of the second quintile . Source: Deininger and Squire [7].
- SS Social security transfers as a percentage of GDP (10-year averages). Consists of bene…ts for sickness, old-age, family allowances, etc., social assistance grants and welfare. Source: OECD, Historical Statistics.
- TH Share of income of the third quintile. Source: Deininger and Squire [7].
- YOUNG: Population proportion under 15 years. Source: Luxembourg Income Study.

Table 1

Descriptive statistics: selected series

	mean	median	max	min	st.dev.	obs.
EDU	0.034	0.036	0.058	0.009	0.011	66
SS	0.130	0.123	0.265	0.042	0.049	54
SEC	0.185	0.191	0.248	0.095	0.035	53
TH	0.356	0.365	0.420	0.200	0.046	53
LTV	73.12	75	95	50	11.83	56

Table 2

Regression results for 22 OECD countries, 10-year averages 1960-1990

	(1)[a]	(2)[a]	(3)[a]	(4)[b]	(5)[a]	(6)[b]
	EDU	EDU	SS	SS	EDU	SS
C	-0.64 (-4.66)*	-0.67 (-4.66)*	-1.85 (-3.41)*	-0.63 (-5.08)*	-0.64 (-4.70)*	-0.60 (-4.99)*
LGDP	0.01 (2.75)*	0.01 (2.56)*	0.04 (1.24)	0.05 (4.24)*	0.01 (3.18)*	0.06 (5.00)*
LPOP	0.05 (3.37)*	0.05 (3.23)*	0.15 (1.90)**	-0.01 (-0.64)	0.05 (3.07)*	-0.01 (-0.86)
YOUNG	0.13 (3.92)*	0.12 (3.73)*			0.14 (4.22)*	
OLD			0.98 (2.27)*	1.37 (5.65)*		1.30 (5.57)*
SEC	0.01 (1.05)		-0.18 (-1.45)		0.14 (1.76)**	0.94 (2.28)*
TH		0.11 (2.51)*		0.37 (3.05)*	0.01 (0.03)	-0.39 (-1.10)
LBC		0.03 (2.11)*		0.17 (3.02)*	0.04 (2.29)*	0.18 (3.42)*
HBC	-0.02 (-2.07)*		-0.09 (-2.98)*			
SHBC	0.11 (2.08)*		0.63 (3.58)*			
TLBC		-0.10 (-2.11)*		-0.53 (-3.31)*	-0.10 (-2.28)*	-0.54 (-3.71)*
R^2	0.82	0.81	0.91	0.60	0.84	0.63
obs.	46	46	40	40	46	40

[a] Estimation method: one-way (country dummies) …xed e¤ects by OLS. t-statistics in parenthesis. * denotes signi…cance at 5% level, ** denotes signi…cance at 10% level. [b] Estimation method: one-way (country dummies) random e¤ects by GLS. z-statistics in parenthesis. * denotes signi…cance at 5% level, ** denotes signi…cance at 10% level.

Table 3[a]

Regression results for 22 OECD countries, 10-year averages 1960-1990

	(1)	(2)	(3)	(4)
	EDU	EDU	SS	SS
C	-.58 (-4.57)*	-.57 (-4.39)*	-1.95 (-3.39)*	-1.98 (-3.37)*
LGDP	.01 (1.68)**	.01 (1.49)	.01 (.17)	.01 (.14)
LPOP	.05 (3.90)*	.05 (3.77)*	.19 (2.64)*	.19 (2.62)*
YOUNG	.08 (2.70)*	.07 (2.47)*		
OLD			.90 (2.30)*	.91 (2.29)*
SEC	.03 (1.72)**		.19 (2.03)*	
TH		.01 (1.24)		.14 (1.78)**
R^2	.74	.73	.83	.83
obs.	53	53	44	44

[a] Estimation method: one-way (country dummies) …xed e¤ects by OLS. t-statistics in parenthesis. * denotes signi…cance at 5% level, ** denotes signi…cance at 10% level.